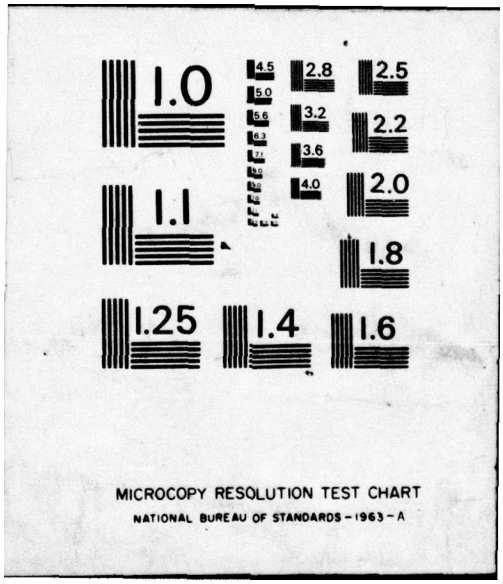
AD-A033 046 NAVAL INTELLIGENCE SUPPORT CENTER WASHINGTON D C TRA--ETC F/G 8/3
INSTRUMENTATION FOR MULTICHANNEL RECORDING OF HYDROPHYSICAL MEA--ETC(U)
OCT 76 V A GOLOSKO, L I DORNER, V M KUSHNIR

UNCLASSIFIED NISC-TRANS-3872 NL

1 OF 1
AD A033046

END
DATE FILMED
1-77


1.0
1.1
1.25
4.5
5.0
5.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8
1.4
1.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

DEPARTMENT OF THE NAVY
NAVAL INTELLIGENCE SUPPORT CENTER
TRANSLATION DIVISION
4301 SUITLAND ROAD
WASHINGTON, D.C. 20390

(3) NW

CLASSIFICATION: UNCLASSIFIED

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

TITLE: (6) Instrumentation for Multichannel Recording of Hydrophysical Measurements

(Kompleks apparatury dlya mnogokanal'noy registratsii gidrofizicheskikh izmereniy)

AUTHOR(S): Golosko, V.A., Dorner, L.I., Kushnir, V.M., Paramonov, A.N., and Khokhlov, A.V.

(11) 27 Oct 76

PAGES: 5 (21) Trans. from

SOURCE: Morskoy Gidrofizicheskiy Institut [illegible], [illegible] N6 (56) [illegible] (12) 6p.
[illegible] p164-170 1971.

(14) NISC-Trans-3872

(USSR)

ORIGINAL LANGUAGE: Russian

TRANSLATOR: C

NISC TRANSLATION NO. 3872

APPROVED P.T.K.

DATE 27 October 1976

(10) V.A./Golosko,
L.I./Dorner,
V.M./Kushnir,
A.N./Paramonov
A.V./Khokhlov

407682

YB

INSTRUMENTATION FOR MULTICHANNEL RECORDING OF HYDROPHYSICAL MEASUREMENTS

[Golosko, V. A., L. I. Dorner, V. M. Kushnir, A. N. Paramonov, and A. V. Khokhlov, Kompleks apparatury dlya mnogokanal'noy registratsii gidrofizicheskikh izmereniy, Morskoy Gidrofizicheskiy Institut, Trudy, No. 6 (56), 1971, pp. 164-170; Russian]

The paper gives a description of instrumentation designed for visualization, digital and graphic recording of data from measuring instruments and individual sensors used for studying physical fields in the ocean.

/164*

Modern methods of studying the characteristics of physical fields in the ocean require synchronous measurements, recording and processing of not only the basic properties of the seawater medium, which determine the genesis and development of the phenomenon studied, but also a whole series of auxiliary parameters characterizing the conditions of the experiment. In many cases, it is impossible to clearly separate the basic and auxiliary information before the studies are begun, since hidden relationships of various phenomena, dependent on the degree of development of a given process, are revealed in the course of the experiment. The set of parameters to be measured is determined by the investigator on the basis of theoretical concepts and a priori information on the nature and dynamics of the phenomenon under study, and, as well, by the availability of measuring devices and their metrological and technical characteristics. Since the capabilities of modern computing are limited by the volume of rapid storage and speed, the operator and specialized resolvers are charged with /165 preprocessing the experimental data (scaling, linearization, introduction of corrections, etc.). The selection of the parameters, their number, and volume of information subject to final processing for the purpose of obtaining the required oceanographic characteristic is determined by the investigator on the basis of all of the available information and its preliminary evaluation allowing for the actual conditions of the measurements in the sea. All this requires an intermediate recording and representation of a whole series of measured parameters. Moreover, the necessity of introducing intermediate information converters and storage is due to the great variety of measuring sources, irregularity of the arrival of information files, the requirement of free design of the data obtained for combined processing, as well as sharing of the universal computer, which usually handles several aspects of the research. The practice of using standard recorders individually for each measured parameter or a limited group of recorders has turned out to be incorrect because of the limitations on the speed, multichanneling, standardization of the forms in which information is presented, etc.

For these reasons, the Marine Hydrophysical Institute of the Ukrainian Academy of Sciences has developed instrumentation designed for multichannel recording and representation of oceanographic information in the course of comprehensive studies aboard scientific research ships of the institute and on the marine experimental range. The equipment provides for multichannel recording of information supplied by measuring units and individual sensors in analog and digital form suitable for further processing by computer. The following requirements for the recording unit were formulated during the study:

*Numbers in the right margin indicate pagination in the original text.

1. Maintaining the resolution and accuracy of the input data at a given level.

2. Since in the majority of cases the statistical structure of the investigated processes is not known in advance, the device controlling the recorder should have several operating modes providing the required speed and duration of recording of the set of parameters in order to obtain statistically valid information.

3. Control of the information acquisition modes should be carried out by the operator as well as automatically, by a special-purpose data preprocessing computer.

4. The system for a clear representation of information should provide for a simple and rapid visual reading of a group of parameters selected at random and finding the extreme and characteristic points of the process studied, which are necessary for controlling the experiment. /166

5. The recording unit should enable the investigator to exercise his discretion in designing the information files to be subjected to the final processing, with their subsequent entry in a computer according to an access program or on command by the operator.

6. The equipment should provide for a reliable recording of the measured information and service (time markings, reference grids, etc.) during the entire course of the experiment.

The recording system of the equipment, a diagram of which is shown in Fig. 1, includes: an amplifier unit, three units for control, conversion and display of data, a magnetic recorder, digital printer, puncher, and two analog plotters. Information can be fed to the input of the recording system in the form of a 12-bit parallel or serial binary code of changing voltage, which corresponds to a measured physical value in the 0-6 V range. The equipment is designed for operation with 16 meters with time separation of channels and 8 sensors in synchronous measurements. With information supplied in the form of a binary code, the capacity is 240 b. u/sec, and in synchronous measurements of 8 parameters, up to 140 b. u/sec. When the information is fed directly to the computer, the equipment provides for information transmission rates up to 500 12-digit words per second. The entire system runs on a mains voltage of 220 V ac, and the intake power is 950 W. /167

The digital information reception unit performs the conversion of the serial code to the parallel code, followed by shaping of code pulses for recording on the magnetic recorder, display on a digital panel and entry in the computer, converts the parallel binary code to the serial code, and performs the selection of the channels for selective indication and coding of information when the latter is fed to the puncher and digital printer. This unit also includes a code simulator, which performs a comprehensive control of the functioning of the individual control units and external recording devices.

The analog information reception unit is designed for receiving the data in analog form over 8 channels with an input voltage amplitude in the 0-6 V range, conversion of this information to a 7-bit parallel binary code, and its distribution with time. This unit includes a converter of the parallel binary code to a voltage fed to the measuring inputs of the plotters. The third unit serves to control the operation of the external recording devices and to display the information

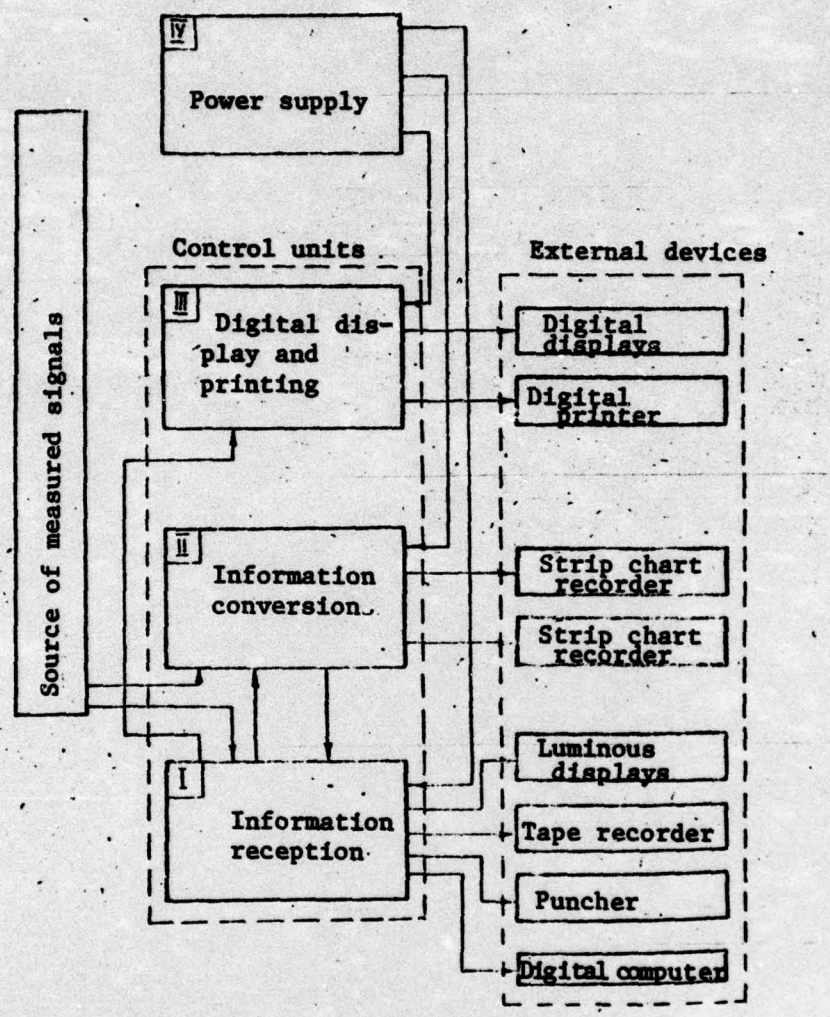


Figure 1. Block diagram of recording system.

on the digital panel. The selection of one or more channels with outputs to the digital printer, perforator or analog plotters is made by means of a channel switch. In addition to the measuring information, the paper tape of the digital printer is imprinted with the number of the channel to which the information corresponds, and the operator's service marks. The recording equipment also includes a unit consisting of series-produced dc electronic measuring amplifiers.

The magnetic recorder is designed for recording and reproducing digital data /168
in the form of a parallel binary code supplied by the digital information reception unit. The number of tracks is 15, and the tape speed is adjusted over a wide range, from 5 to 100 cm/sec.

In the recording equipment, the magnetic recorder is used as a buffer for reproduction by the plotters, digital printer and puncher, which have a low speed, of observational data measured at a high frequency (up to 30 measurements/sec).

Studies to determine the statistical structure of the light field in the sea and processes in the ocean-atmosphere boundary layers were carried out with the aid of the elaborated equipment and system of measuring sensors mounted on a gradient mast in the coastal region of the sea on the institute's marine experimental range.[4] The research program included measurements of irradiance, fluctuations in the index of light attenuation by seawater at different levels, measurements of sea surface elevation, micropulsations of the pressure on the wave surface, vertical and horizontal components of flow velocity at various depths in the wave layer, water and air temperature, and wind speed and direction. Information from the measuring sensors was transmitted in the form of analog signals by a multicore cable laid on the sea floor to a laboratory on the shore, and fed to the recording system through a multichannel wideband amplifier unit. The recording and representation of the data were carried out in two steps. First, the averaged and fluctuation components of the investigated processes were encoded and recorded on a magnetic recorder in the form of a parallel binary code. In order to obtain the results of the studies with a specified distortion level irrespective of the statistical structure of the processes studied, the frequency of the measurements was established by an adaptive special-purpose computer which had analyzed the measured process in real time. The range of measurement frequencies was 0.03-30 Hz. The recording on magnetic tape was made at a tape speed of 65 cm/sec, and the time between channels in the time separation did not exceed 4-5 m/sec. Simultaneously with the recording of information on the magnetic medium, a selective recording of individual parameters was made on the two analog plotters during the experiment, so that changes could be introduced into the initial program.

In the second step, the information sources were disconnected from the input of the recording system, the recorded data were reproduced at a low speed (6.5 cm/sec) of the magnetic recorder, and the information was fed to the puncher and digital printer. /169 The reproduction rate was limited by the speed of the external recording devices. Simultaneously with the reproduction of information, data were recorded on the analog plotters, and control with the digital panel was carried out. This made it possible at the end of the experiment to estimate the metrological and operational characteristics of the recording system. The entire information obtained in the course of the 4-month studies was processed on a computer. Typical spectra of the waves and wind pressure on the wave surface, obtained in the course of this study, are shown in Fig. 2. As is evident from the graph, the decrease of the wave spectrum is similar to the law $s = kf^{-5}$ (Phillips spectrum), the level of spectral distortions in the high-frequency region was specified by the program of the experiment, and the measuring mode was established automatically by the adaptive control device.

The tests showed a high efficiency of the equipment. Despite the unfavorable climatic conditions during the expedition and a relatively complex circuit (the control units alone include over 1000 potential inverters), during the 4-month period, there was only one malfunction, due to the failure of a potential inverter. Isolated malfunctions which resulted in a distortion of the acquired information took place during the recording of measurement data. Their main source was switching noise in the mains. Particularly sensitive was found to be the tape recorder, operating in the playback mode. The number of failures per unit time was found to be a random quantity dependent on temperature, supply voltage, and other factors. Analysis showed that the average number of undistorted words per failure was 1672, although in some cases, series of observations consisting of 6000 words were reproduced without distortion.

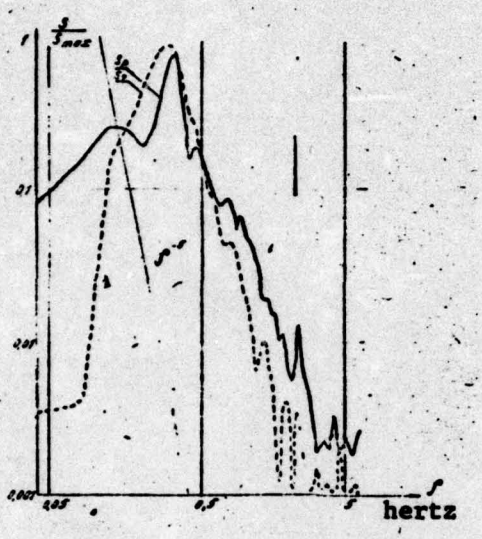


Figure 2. Spectra of sea surface elevation and pressure on the wave surface, obtained by digital computer processing of recorded information.

Tests of the recording system clearly demonstrated its advantage over graphical recording (plotters, loop oscillographs), which are still widely employed in experimental hydrophysical studies. /170

REFERENCES

1. Goodheart, A. I., The "Odessa" system (Ocean data environmental science services acquisition system). Electronic Engineering in Oceanography, London, 1968.

2. Siedler, G., In situ measurements and automatic recording of conductivity temperature and pressure. London, 1968.

3. Weidemann, H., Telemetry from an undulating body. London, 1968.

4. Kolesnikov, A. G. and V. V. Yefimov, Study of the boundary layers of the atmosphere and ocean. In: Morskiye gidrofizicheskiye issledovaniya, No. 1 (47), Sevastopol', MGI AN USSR, 1970.